Exploring IR4.0 Strategy in Post Covid-19 era through Insights from FDI Inflows

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Abstract: Published research on Industrial Revolution 4.0 (IR4.0) is centered around conceptualization and public policy announcements, staying largely esoteric and under-explored. However, with Covid-19 Lockdowns creating an economic crisis out of a health crisis, India will put its IR4.0 strategy on fast-track to play a meaningful role in the global supply chain rivalling Indonesia and Philippines. The current study analyzes FDI inflows to India between 2013-14 and 2018-19 using a GLM repeated measures model to uncover insights regarding industry verticals and investor countries that offer future business opportunities. The study found that FDI inflows to India are volatile and though USA is a large investor there are no significant differences among investor countries. Rather than manufacturing, service sector attracts FDI and India's IR4.0 strategy can be built on software development for industrial IoT, human-machine interface technologies and collaborative software. Indian businesses should improve their financial performance by deleveraging. It is also pertinent that public policy focuses on improving business environment and plan out the structural changes that will occur with IR4.0 addressing the employment and skilling threats.

Keywords: IR4.0; Covid19; FDI; IoT, HMI, robotics, financial ratios, GLM

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I. INTRODUCTION

Published research on Industrial Revolution 4.0 (IR4.0) is centered around conceptualization and public policy announcements, staying largely esoteric and under-explored. However, with Covid-19 Lockdowns creating an economic crisis out of a health crisis, particularly in countries such as India and USA, it is likely that the vision of IR4.0 will influence new initiatives and collaborative efforts in a post-Covid19 world realigning to the new normal. India will put its IR4.0 strategy on fast-track to play a meaningful role in the global supply chain. This paper seeks to extend the research literature by studying the possibility of IR4.0 business opportunities for India by looking at trends in FDI in-flows for the period 2013-14 to 2018-19 and by analyzing the financial management of FDI companies. The paper aims to close the research gap by describing and explaining the industries and countries that are best-fit for India's IR4.0 ambitions. To achieve this objective, a general linear model with repeated measures is applied to a panel data consisting of yearly count of FDI companies reporting to RBI for the period 2013-14 to 2018-19 across nine industry verticals and from 10 investor countries. The study found that though some industry verticals attract FDI, India is not a manufacturing destination, FDI inflows are fickle and most investor countries do not have a strategic buy-in with India through FDI commitments. The main conclusion is that IR4.0 strategy for India can be based on software development for industrial Internet of Things, Human-Machine interface and robotics software. Also, improving Indian business environment and practices in India should be a part of the post Covid19 strategy.

The rest of this paper is organized as follows: section 2 comprises review of literature, followed by method and empirical results. Sections 5 and 6 contain discussion and conclusion which will provide insights for IR4.0 opportunities in India from the dimensions of industry verticals, country and financing.

II. REVIEW OF LITERATURE

Greater complexity in product design, increasing volatility in markets, shrinking lifecycle of products and growing integration in global supply chains (Schmitt, 2015) along with changing demographics across world regions and increasing pressure on depleting natural resources – these are the foundations on which industrial revolution 4.0 (IR4.0) birthed around 2006 and rebirthed within the sustainability parameters in 2015. The frontrunner in this compelling agenda has been Germany with both the Government and private companies such as Siemens and Bosch spotting this opportunity early on and since then IR4.0 has donned various faces across the globe - “Innovation 25” (Japan), “Connected Enterprise” (USA) “Made in China 2025” and “Smart Manufacturing” (China) and Make in India and Digital India (Stăncioiu, 2017). The business opportunity from IR4.0 created a diverse landscape of cooperation and collaboration in research, technology adoption, funding, training and security systems. The following sections provide a brief review of IR4.0 from global and Indian perspectives and FDI inflows into India.

A. Evolution and market opportunity of Industrial Revolution 4.0

(Schwab, 2016)digitization had been a major trend across the globe with more than 50% companies pivoting to the digital economy but with the onset of Covid19 pandemic this has increased manifold due to the pressures of business continuity, end-to-end customer journey, cost cutting and risk management – building an even stronger case for IR4.0. The term *fourth industrial revolution* was first coined by Klaus Schwab, executive chairman of WEF to highlight the possible coming together of software, hardware and biology as cyber-physical systems due to rapid innovation in ICT and seamless connectivity (Schwab, 2015). Industry 4.0 is an evolution of the prior three inflection points that ushered large-scale technological transformation in the history of mankind: steam power, electricity and computing power (Cordes & Stacey, 2017). Nine valuable tracks have emerged under the umbrella of IR4.0, these being – cloud computing, big data, augmented reality, additive manufacturing, autonomous robots, IoT, cyber security, system integration and simulation.

IoT is the fastest growing segment in this market, followed by industrial robots and IR4.0 is set to grow at a CAGR of 16.9% to $156.6 billion in 2024 up from current global market size of $71.7 billion (MarketsandMarkets, 2019). Asian Tigers such as Singapore, South Korea, Taiwan and Malaysia have grown systematically on the strength of their industrial development and APAC forms almost 50% of IR4.0 market. Established leaders such as Singapore have garnered pole position with 50% of workforce engaged in hi-tech, skilled, export-oriented manufacturing (Kwong, 2018) and focused aspirants such as Vietnam have been planning for productivity gains of 7% per year and a 20% share of digital economic activities in its GDP (Dharmaraj, 2019). Though India is in the nascent phase of IR4.0 compared to global trends, a post-Covid19 world will force India to speed up this process and move up quickly from its 2019 Network Readiness Index (NRI) ranking of 79 out of 121 countries. Vietnam and Philippines are fast emerging as preferred manufacturing locations in Asia – replacing China and Taiwan. Yet India too offers similar strengths such as strategic location, youthful population and an IT savvy workforce.

The global benchmark indicator NRI 2019 provided by WEF, INSEAD and Cornell University has provided an overall mixed verdict for India’s progress and readiness in technology adoption, identifying a few strengths such as trust, regulation and inclusion, leading to 52nd rank in Governance and 46th rank in level of future technologies but major weaknesses persist in poor ICT usage and skills as exhibited by individuals and businesses as well as poor evidence in impact parameters (Lanvin et al., 2019). Similarly, despite its clear advantage in trade agreements vis-à-vis EU, Vietnam’s factories are still stuck in IR2.0 processes and practices (Vu & Anh, 2017). On the other hand, Consumer Internet of Things (IoT) is vibrant in India and Industrial IoT is expected to soon catch up. With a CAGR of 62.96% India’s market for IoT enabled sensors is expected to grow to Rs. 81.07 billion in 2024, growing exponentially from

2018 level of Rs. 4.83billion (Research and Markets, 2019). Augmenting manufacturing sector's contribution to 25% of GDP by 2025, up from current level of 16% is an ambitious but necessary plan if India intends to compete with automotive powerhouse Philippines which averages 22% GDP value add by manufacturing and has active Govt. policy to push this to 30% (WB, 2018).

Digitization and smart technology adoption from consumer side has been smooth in India. Smart glucometers have found ready acceptance in the healthcare sector (Diabetacare being an example) and smart IoT solutions for healthcare and utility management have become a part of core services offered by telecom companies such as Vodafone and Airtel. Besides, industry too has aligned to the cyber-physical opportunities especially adopting collaborative robots in the manufacturing process - Bajaj Auto, Aurolabs, L'Oreal India, Shruti Engineers and New Engineering Works being a few front runners. India's first M2M, IoT ready Smart Factory is soon to come up at Bangalore under the aegis of Indian Institute of Science (IISc), being developed by its Centre for Product Design and Manufacturing (CPDM) with The Boeing Company funding the endeavour (engineersouls, 2019). Govt. of India is very focused on joining the digital, sustainable era and has launched several policies directed at this vision over the past six years, such as National Electric Mobility Mission Plan (NEMMP), Faster Adoption and Manufacturing of Hybrid Land Electric Vehicle (FLAME), Smart City, Digital India, Make in India and National Automotive Testing and R&D Infrastructure Project (NATRiP) to name a few and these have attracted foreign direct investments in good measure.

B. Role of Foreign Direct Investment in India's economic aspirations

Government of India's FDI policy in particular and trade regime in general, in the post-1991 era, has been formulated and implemented largely to attract direct overseas funding and route it to the manufacturing sector and augment capacity creation (Rao et al., 2014). Extensive studies have reported that FDI inflow has a positive impact on a country's economic growth (Agrawal & Khan, 2011; Dash & Parida, 2013), especially via technology spillover and enhanced productivity (Yao 2006). The business and operational cooperation in FDI between two countries creates a climate of risk sharing, knowledge exchange and innovation. Yoon Jung Choi and Jungho Baek (2017) have applied Granger Causality to FDI inflow and concluded that there has been positive economic spillover effect of FDI inflow to India through improvement in total factor productivity. However, the authors warn that this effect is difficult to observe and record in primary industries which are not technology intensive by nature. Similarly, Ma Yingxi and Juann H. Hung (2018) have undertaken a comparative analysis of growth effect of FDI inflows to China and India and have found the impact to be more significant for the former. The authors have concluded that better infrastructure, deeper learnability and higher productivity have created an edge for China and the country has reaped the benefits of the business efficiency learning curve.

Patra (2019) also has reported causality and linkages between FDI inflows, GDP and urbanization when having scrutinized India and China for his study. In fact, (Choi & Baek, 2017) have made the case for India to attract greater FDI inflows in finance, telecommunication and software to facilitate smooth technology transfer and India's advancement on a higher trajectory of industrial activity. Yet studies have cautioned that if FDI is routed through acquisition, as is the case in 54% of inward FDI to India then there will be no accretive effect (Rao et al., 2014). Consequently, the long-term economic spillover from FDI is highly sensitive to type of investor, investment objective, investment vehicle and host country attributes.

The current paper focuses on this implication and tries to explore FDI trends based on industry segments and country investors to understand the real opportunities available for India in IR4.0. Rao et al., 2014 have critiqued that most researchers anchor their study merely in the reported quantum of FDI announced between the host and investor countries, with poor regard to actual inflows and business decisions. This study seeks to fill this research gap and use data regarding number of FDI companies operating in and reporting to RBI in India. Observing the trends in FDI companies based on their origin and the industries that they operate in can reveal best-fit between host and investor country and consistency in the trend based on number of FDI companies year on year can provide an understanding of brand India. The research question being asked is whether there is any significant difference in FDI companies in India based on industry verticals or based on investor countries and is time interaction with each of these factors significant? Does the data reveal any clear pattern towards any particular industry or any particular investor country so that this can inform India's IR4.0 strategy for the post-Covid19 period? Is India a preferred destination for any specific business opportunity?

III. RESEARCH METHODOLOGY

Rao et al. (2014) have found that for the period up to 2014, Indian FDI inflows were predominantly through acquisition mode and despite its objective to expand its manufacturing base and cooperation with foreign investors the country has had very limited success. Hence, the current study focuses on the period 2013-14 onwards. The originality of the study is that it analyzes the FDI firms that are reporting to RBI on a yearly basis rather than analyzing the quantum of FDI funds received year on year from the top 10 investor countries which form the sample of this study. Data for six years from 2013-14 to 2018-19 was analyzed for top 10 FDI investor countries, across 9 industry segments of which 6 were from manufacturing segments namely – food products and beverages (FPB), chemicals and chemical products (CCP), rubber and plastic products (RPP), motor vehicles and other transport (MVT), machinery and machine tools (MMT), electrical machinery and apparatus (EMA) and 3 from services – wholesale and retail trade (WRT), computer and related activities (CRA) and transport, storage and communications (TSC). The sample of investor countries consisted of France, Germany, Japan, Mauritius, Netherlands, Singapore, Switzerland, UAE, UK and USA.

Data was extracted from RBI's State of the Economy portal and was analyzed using General Linear model with repeated measures through SPSS 23. Since this study seeks to investigate changes in number of FDI companies operating in India per year within various industry segments over six time points this is the appropriate tool of analysis. Also, the method allows data to be analyzed under control conditions such as investor country or industry vertical. Generally, repeated measures design increases the validity of the experiment and keeps variability low and is desirable for small samples (Holland, 1986). However, the method is found to be highly sensitive to missing data points, unequal time lags between observations and to violations of sphericity leading to inflated type 1 error.

Hypothesis 1: There is no significant difference in change in no. of FDI companies based on time.

Hypothesis 2: There is no significant difference in change in no. of FDI companies based on investor country

Hypothesis 3: There is no significant difference in change in no. of FDI companies based on interaction between years and country.

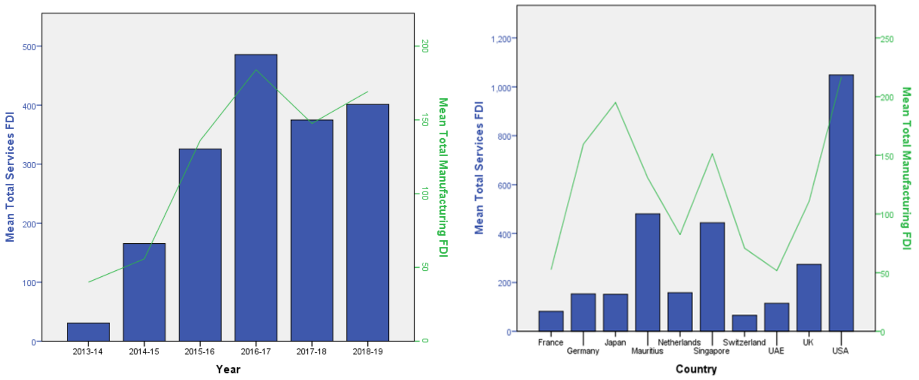
IV. DATA ANALYSIS AND INTERPRETATION

A. *Descriptive Results*

Table 1 reveals that no. of inward FDI companies in India per year saw a steep rise from 2013-14 till 2016-17, followed by a fall and then recovery in the next two years. The average no. of companies at start of period of interest was 4 and it stands at 32 currently. Though the data clearly shows that the variable of study does not follow normality conditions of first to fourth order moments, general linear model is applied as it is assumed that global market for investible funds is efficient and FDI funding follows normal distribution.

Table 1: NO. OF FDI COMPANIES PER YEAR FOR TOP 10 INVESTOR COUNTRIES IN INDIA

	2018-19	2017-18	2016-17	2015-16	2014-15	2013-14
N Valid	90	90	90	90	90	90
Mean	32.24	29.90	38.43	27.06	13.42	4.03
Median	15.50	13.50	18.00	11.00	7.00	2.00
Mode	4	2	5[a]	5	1	2
Std. Deviation	78.899	76.892	102.210	68.322	30.878	4.840
Skewness	7.906	8.036	8.169	7.891	7.582	2.753
Kurtosis	69.265	70.974	72.685	68.966	64.897	10.280
Minimum	1	2	1	0	0	0
Maximum	727	711	949	628	281	30



Charts 1 and 2: COMPARISON OF FDI COMPANIES IN SERVICE SECTOR VS. MANFACTURING SECTOR – BASED ON YEAR AND BASED ON COUNTRY

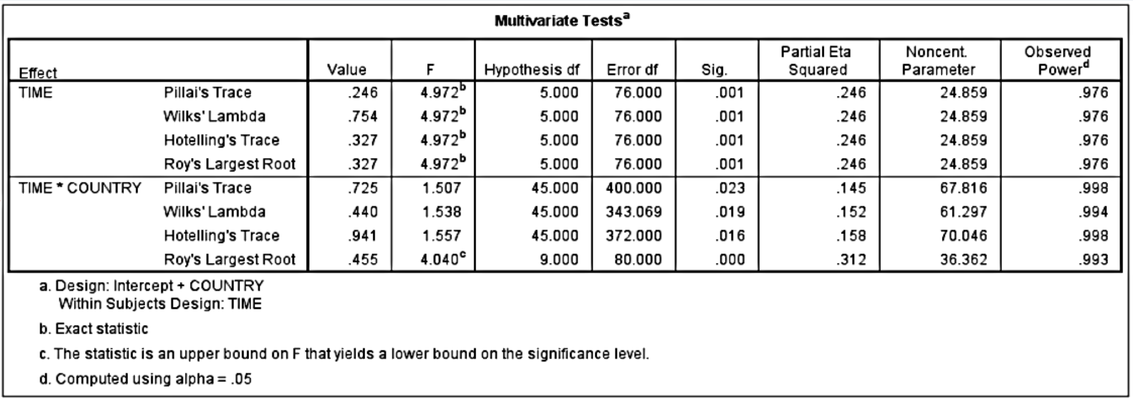
The general linear model with repeated measures was run on the data with investor country as the control variable or factor and between-subjects observations were six time periods. The results are as follows -

B. Box's Test of Equality of Covariance Matrices

Box's M	704.194
F	2.527
df1	189
df2	6215.611
Sig.	.000

Box's M statistic indicated that observed covariance matrices for the dependent variables are not equal across groups. However, according to statistical theory, multivariate results are considered to be fairly robust if there are equal number of items in each group (Pituch and Stevens, 2016). This condition is satisfied by the data.

C. Multivariate Results



Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
TIME	Pillai's Trace	.246	4.972[b]	5.000	76.000	.001	.246	24.859	.976
	Wilks' Lambda	.754	4.972[b]	5.000	76.000	.001	.246	24.859	.976
	Hotelling's Trace	.327	4.972[b]	5.000	76.000	.001	.246	24.859	.976
	Roy's Largest Root	.327	4.972[b]	5.000	76.000	.001	.246	24.859	.976
TIME * COUNTRY	Pillai's Trace	.725	1.507	45.000	400.000	.023	.145	67.816	.998
	Wilks' Lambda	.440	1.538	45.000	343.069	.019	.152	61.297	.994
	Hotelling's Trace	.941	1.557	45.000	372.000	.016	.158	70.046	.998
	Roy's Largest Root	.455	4.040[c]	9.000	80.000	.000	.312	36.362	.993

a. Design: Intercept + COUNTRY
Within Subjects Design: TIME

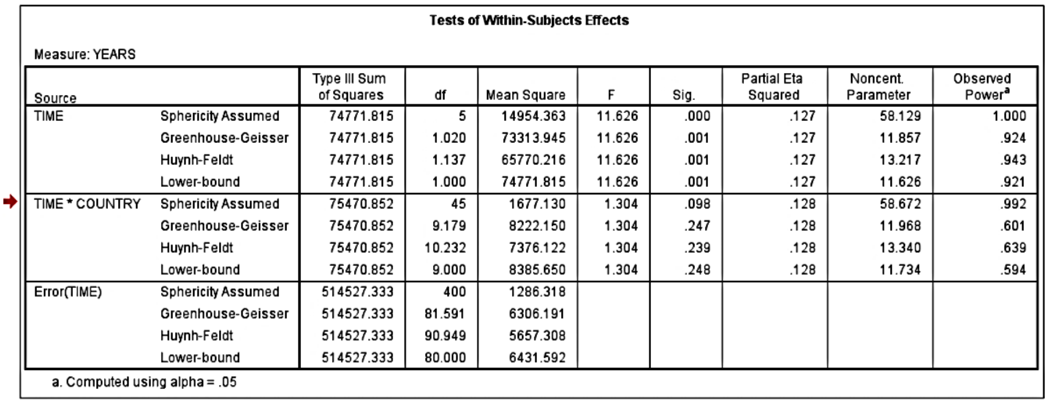
b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Computed using alpha = .05

The Multivariate test results exhibit effects for time and for time and country interaction. The main effect of time is found to be significant as Wilks' Lamda = 0.754 and F(5, 76) = 4.972, p < 0.001. This effect is qualified by a significant time*country interaction, Wilks' Lamda = 0.440 and F (45, 343) = 1.538, p < 0.019. Also, Greenhouse Geiser epsilon value is applied for sphericity assumption.

Within Subjects Effects



Tests of Within-Subjects Effects

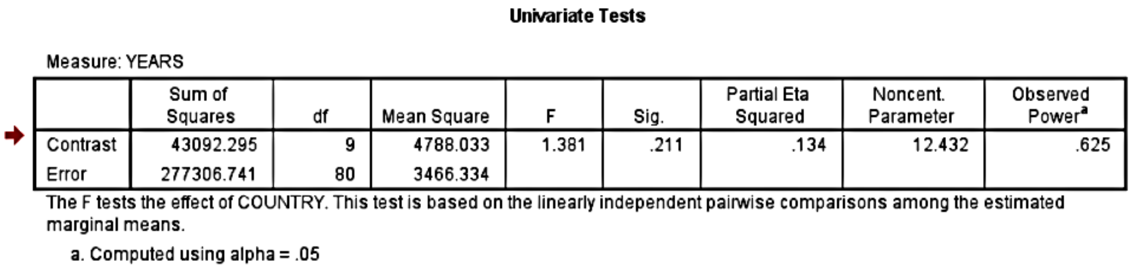
Measure: YEARS

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
TIME	Sphericity Assumed	74771.815	5	14954.363	11.626	.000	.127	58.129	1.000
	Greenhouse-Geisser	74771.815	1.020	73313.945	11.626	.001	.127	11.857	.924
	Huynh-Feldt	74771.815	1.137	65770.216	11.626	.001	.127	13.217	.943
	Lower-bound	74771.815	1.000	74771.815	11.626	.001	.127	11.626	.921
TIME * COUNTRY	Sphericity Assumed	75470.852	45	1677.130	1.304	.098	.128	58.672	.992
	Greenhouse-Geisser	75470.852	9.179	8222.150	1.304	.247	.128	11.968	.601
	Huynh-Feldt	75470.852	10.232	7376.122	1.304	.239	.128	13.340	.639
	Lower-bound	75470.852	9.000	8385.650	1.304	.248	.128	11.734	.594
Error(TIME)	Sphericity Assumed	514527.333	400	1286.318					
	Greenhouse-Geisser	514527.333	81.591	6306.191					
	Huynh-Feldt	514527.333	90.949	5657.308					
	Lower-bound	514527.333	80.000	6431.592					

a. Computed using alpha = .05

For within subjects effects, the study found a significant main effect of time but no interaction effect between time and country. Applying Greenhouse-Geisser criterion, it is reported that F(5,400) = 11.626, p < 0.001 for main effect of time and it is reported that F(45, 400) = 1.304, p < 0.239. Thus, it can be observed that though there are differences in no. of FDI companies per year in India, these are not effected by the origin of FDI funds. The time effect is not unsual to any specific investor country.

D. Univariate Results for Investor Country



Univariate Tests

Measure: YEARS

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Contrast	43092.295	9	4788.033	1.381	.211	.134	12.432	.625
Error	277306.741	80	3466.334					

The F tests the effect of COUNTRY. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

Univariate results confirm that no. of FDI companies based on FDI funding is not significant. F(9, 80) = 1.381, p < 0.211.

Thus, based on GLM repeated measures test we conclude that –

There is significant difference in change in no. of FDI companies based on time period

There is no significant difference in change in no. of FDI companies based on investor country

There is no significant difference in interaction between time and country at multivariate level.

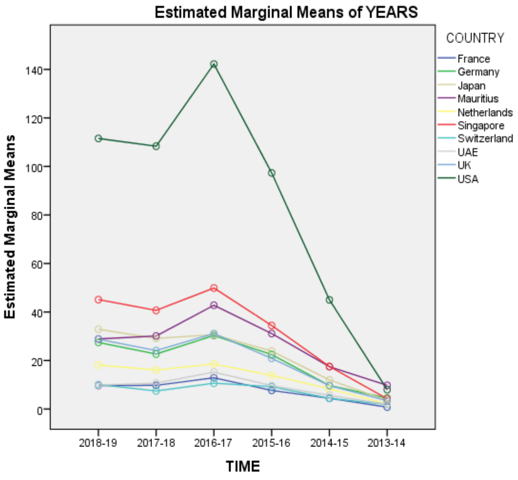


Chart 3: ESTIMATED MARGINAL MEANS FOR NO. OF FDI COMPANIES OVER TIME

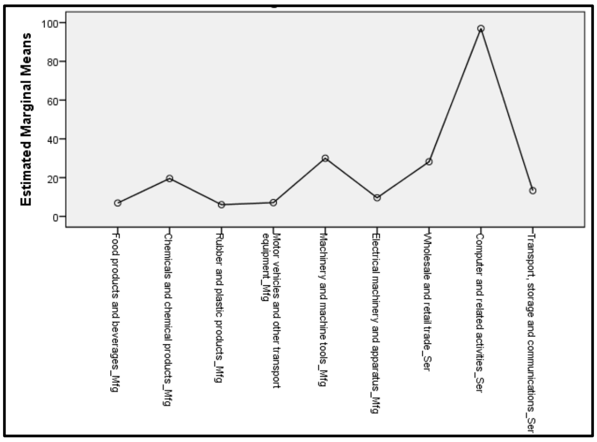


Chart 4: ESTIMATED MARGINAL MEANS OF FDI COMPANIES BASED ON INDUSTRY VERTICALS

Chart 3 reveals that across the 10 countries there was a similar pattern of initial increasing FDI from 2013-14 to 2016-17, followed by a sharp drop in the number of FDI companies between 2016 -17 and 2017-18. However, this trend was reversed the following year for most countries except Mauritius and UK. In Chart 4 it is evident that India has been the preferred destination for Computer and related activities with on an average 100 FDI companies operating in this vertical per year (the largest no. recorded was 949 companies by USA in 2016-17). Service industry gets 64% of FDI business and this is more than twice that which goes to the manufacturing industry. Within the service sector, computer and related activities form 33%. In manufacturing sector, machinery and machine tools attracts about 25% of the manufacturing business, followed by chemicals and chemical products getting 16% of FDI inflows. Motor vehicles and other transport equipment as well as Rubber and plastic products have attracted the least no. of FDI companies in India.

E. Financial Analysis of FDI companies in India for the period 2016-17 to 2018-19

Considering the financial ratios of 8095 FDI companies in India for the past 3 years given in table 2 below, it is observed that they exhibit very robust financial management with high liquidity, low levels of leverage and efficient asset utilization. Cost of raw materials seems to be high, cheap Indian labour is a cost advantage and low debt keeps their interest bill low. As regards profitability, FDI companies in India seem to follow profit retention strategy to pool back money into the business, they also seem to pay their parent company good dividend and follow sound provisioning strategy. These attributes are barely common to their Indian counterparts which are often levered and operate on thin margins.

Table 2: Financial Ratios of 8,095 FDI Companies in India for past three years

	Ratio expressed as %	**2016-17**	**2017-18**	**2018-19**
Capital structure	Net fixed assets to total net assets	32.4	30.9	30.1
	Net worth to total net assets	44.5	45	46
	Debt to equity	31.3	28.3	26.2
	Total borrowings to equity	45.7	41.3	37.9
	Short term bank borrowings to inventories	30.2	30.4	28.6
Liquidity	Current assets to current liabilities	1.3	1.4	1.4
	Quick assets to current liabilities	75.1	78.4	78.7
	Current assets to total net assets	46	47.7	48
	Trade Payables to current assets	32.4	34	33.5
Asset Utilization	Inventories to sales	11.4	11.2	11
	Trade Receivables to sales	13	14	14
	Exports to sales	5.5	4.2	3.8
Expenditure Ratios	Cost of raw materials to total expenditure	54.8	57.7	59.6
	Remuneration to employees to total expend	12	12.2	12
	Interest paid to total expenditure	2.7	2.8	2.6
	Interest coverage ratio (EBIT to interest)	3.9	4	3.9
Profitability	Gross profit (EBIT) to sales	10.3	10.6	9.6
	Profit after tax to sales	5	5.2	5
	Gross profit (EBIT) to total net assets	9.9	10.1	9.6
	Profit after tax to net worth	10.8	10.9	10.8
	Tax provision to PBT	29.1	28.8	28.5
	Profit retained to PAT	68.5	69.9	63.5
	Dividends to net worth	4.8	4.5	5.5

F. DISCUSSION

The study confirms the rising proportion of FDI funds going to service industry over manufacturing industry, as first observed by Rao et al., (2014) and Indian service sector has received Rs. 639 billion in 2019 fiscal (DIPP, 2019). The unexpected result from hypothesis testing is that year on year changes in FDI companies is significant signaling that FDI inflows are volatile. Drastic fall in 2016-17 and subsequent recovery can partly be explained by political risk in an election year, but this may not be a sufficient reason for this unusual activity. Further data is required to fully explain this main effect in the time variable.

USA accounts for 57% of the top 10 FDI funding to computer and related activities, followed by Mauritius and Singapore. France has invested primarily in machinery and machine tools while USA and Singapore have invested in wholesale and retail services as well in chemicals and chemical products vertical. Electrical machinery and apparatus have dominant American, Japanese and German funding. Rubber and plastic products business vertical is popular with Germany, UAE and USA. Transport, storage and communication finds investment from USA, Singapore, Mauritius and UAE. Motor vehicles and other transport equipment found less than 1.5% funding despite India's flagship 'Make in India' policy. Philippines has emerged as a low-cost leader in automotive business, displacing China. Also, investor countries may be looking beyond cheap labour and focusing on skills and productivity. India's productivity to wage is merely 4:1, unimpressive when compared with its Asian rivals Philippines 9:1, China 7:1 and Malaysia 6:1 (McKinsey India, 2018)

USA tops with 23% FDI companies having US funding, while Mauritius (12.29%) and Singapore (11.7%) vie for the second place. The study reports that UK is India's fourth largest investor but seems to have no industry preference. It is very important to understand how India is perceived by these top 10 countries as most of the top 10 countries also feature in NRI top 10 rankings for IR4.0. USA holds rank 8, Singapore holds rank 2, Germany is 9th and UK is 10th. Netherlands which is ranked 3rd in NRI ranking, is India's 7th largest investor country and Switzerland, ranked 5th in features at the bottom of the FDI 10 - neither Netherlands nor Switzerland exhibit any India-specific strategic investments through FDI route.

The results from hypothesis testing clearly indicate high volatility in the FDI inflow to India. Despite, three decades of actively pursuing FDI, India as yet faces uncertainty and there has been no capacity building, negligible manufacturing prowess and poor upskilling. This is in agreement with the conclusion of Rao et al. (2014) that FDI inflows to India did not result in capacity expansion as per the Govt. expectations.

V. CONCLUSION

Using FDI trends as a guide to India's IR4.0 strategy this paper offers three key insights. First, India attracts increasing FDI inflows in computer and related activities year on year. Since IR4.0 is embedded in computing capacity and data management, this can be a strength that India can exploit, especially in terms of software development for cyber-physical systems, human-machine interface (HMI) such as voice, gesture recognition, eye-movement, AR and such. However, this strategy may still not benefit India as these developments would be client driven, but India needs to quickly pivot to Industrial software development to grab a share of the industrial IoT segment. It needs to develop skills in big data and intelligent platform. This is India's Achilles heel as it is absent in cloud service – a business dominated by giants such as Amazon, IBM, Google, SAP dominate. India has a few start-ups in the robot manufacturing such as Grey Orange Robotics, Systemantics, Gridbots, etc. but scaling production for

Indian market will be a big hurdle since demand is merely 1 lakh units (MarketsandMarkets, 2019). Also, China alone produces 1/3rd of collaborative robots (cobots) in the world. Alternatively, software development for cobots could be a key IR4.0 business opportunity.

Secondly, financial management is a core competence of FDI companies that Indian counterparts need to emulate. Though American companies have the advantage of low interest funds it is still evident in the analysis that they are not heavily levered, Debt-equity ratio averages 30%, but India companies operate at dangerously high D/E levels being 84% (2017) and 93% (2016) as reported by Nomura India for BSE 500 (ex-bank) companies. Besides, preference for equity capital and professional management of the company are other advantages lost as Indian businesses are mostly family businesses. Direct accountability and performance management metrics can be adopted to ensure better resource utilization.

This paper supports the policy recommendation provided by Rao et al. (2014) that focusing on FDI has not proven strategically beneficial to India and the Govt. should instead address pain points of local businesses namely bureaucracy and corruption in Govt. offices, labour issues, infrastructural bottlenecks and GST implementation woes. Improving existing Indian assets will be a better focus than chasing the empty FDI dream for establishing and scaling its manufacturing strategy. In the immediate term, the Govt. needs to protect the fragile business eco-system in India ravaged by the pandemic by offering solid fiscal support.

Third and most important implication is that post Covid19, it is extremely pertinent that the Govt. avoids jingoism of IR4.0. Large blue collar and grey collar labour market, vulnerable MSMEs and major challenges in skilling – these are realities in India and though IR4.0 may seem inevitable it needs to be planned and inclusive. Just as solar energy strategy is being implemented slowly by anchoring it in Indian cultural preferences so also adopting automation needs to be anchored in real operational benefits while transfering existing labourforce to new skills and newage jobs. Indian businesses can reap savings between 10% to 40% on cost due to wastage, delays, strikes, idle time and mismanagement but the path to automation will not be smooth and linear.

The implications for business practice is that FDI inflows may not seem as direct competitors but indirectly efficient capital always drives out inefficient capital. In the post Covid19 age of cooperation and collaboration Indian companies will do well to learn lean financial management, sales mangement and brand management from their FDI counterparts. These age-old business lessons will be useful in all scenarios – current, in IR4.0 and beyond.

Further research can be undertaken to fully explore the phenomenon of FDI company’s commitment to host country, their exit strategy, their financial management and reporting mechanism in host country. Also research can be undertaken to explore FDI outflow as an extension of a nation’s trade and larger economic policy. Though IR4.0 has remained a largely conceptual discourse, academic research has largely left this evolution underexplored. Case studies of early movers in the Industry4.0 strategy, in AI/ML adoption, in collaborative efforts to create industry protocol are all interesting probe points.

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